

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

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1 1. A method of treating a region of skin
2 comprising the steps of applying pulsed light, heating
3 collagen and shrinking the collagen, thereby reviving
4 the elasticity of the collagen and of the skin.

1 2. The method of claim 1, further comprising the
2 step of protecting the epidermis and outer layers of the
3 skin by cooling the epidermis and outer layers of the skin.

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1 3. The method of claim 2 wherein the step of
2 cooling includes the step of applying a transparent
3 substance having a temperature less than an ambient
4 temperature, to the region of skin.

1 4. The method of claim 3 further including the
2 step of controlling a delay time between the application of
3 the substance and the application of light, to control a
4 temperature distribution within the skin.

1 5. The method of claim 3 wherein the substance
2 is ice.

1 6. The method of claim 3 wherein the substance
2 is a gel.

1 ^{Sub C21} 15. The method of claim 14 further including the
2 step of controlling the radiation spectrum by filtering the
3 light to control a temperature distribution within the skin.

1 ¹⁸ 16. The method of claim ¹⁷ 15 further including the
2 steps of controlling a pulse duration and applying multiple
3 pulses to control a temperature distribution within the
4 skin.

1 17. The method of claim 1 wherein the step of
2 applying pulsed light includes the step of applying light
3 having a wavelength in the range of 600-1200nm.

1 18. The method of claim 1 further including the
2 step of directing the light to the skin using a flexible
3 light guide.

1 19. The method of claim 1 further including the
2 step of directing the light to the skin using a rigid light
3 guide.

1 20. A method of generating a temperature
2 distribution inside a region of skin having a maximum
3 temperature at a selected depth comprising the steps of
4 cooling the epidermis and outer layers of the region of
5 skin and applying pulsed light to the region of skin.

Sub 05 1 21. The method of claim 20 wherein the step of
2 cooling includes the step of applying a transparent
3 substance having a temperature less than an ambient
4 temperature, to the region of skin.

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1 28. The apparatus of claim 25 wherein the pulsed
2 light source includes a microprocessor for determining the
3 delay time in response to a selected collagen heating depth.

1 29. The apparatus of claim 26 including means for
2 reducing the temperature of the cooling substance, wherein
3 the cooling means is disposed to provide a signal indicative
4 of cooling to the timer.

1 30. The apparatus of claim 25 wherein the pulsed
2 light further includes a pulse formation circuit and a pulse
3 duration input, wherein the pulse duration circuit controls
4 the duration of pulses in response to the pulse duration
5 input.

1 31. The apparatus of claim 25 wherein the pulsed
2 light source includes a laser.

Sub 97 1 32. The apparatus of claim 31 wherein the laser
2 is a Nd(Yag) laser.

1 33. The apparatus of claim 31 wherein the laser
2 is a ruby laser.

1 34. The apparatus of claim 25 wherein the pulsed
2 light source includes a noncoherent light source.

1 35. The apparatus of claim 25 further including a
2 filter disposed adjacent to the aperture, wherein a
3 temperature distribution within the skin is controlled in
4 response to a radiation spectrum produced by filtering the
5 light.

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1 ⁷36. The apparatus of claim ^L35 wherein the filter
2 is of the type that does not eliminate light having a
3 wavelength in the range of 600-1200nm.

1 ~~37. The apparatus of claim 25 further including a~~
2 ~~flexible light guide attached adjacent to the aperture.~~

1 ~~38. The apparatus of claim 25 further including a~~
2 ~~rigid light guide attached adjacent to the aperture.~~

Subg 1 39. A method of cutaneous/resurfacing of a region
2 of skin comprising the steps of producing Er:YAG laser
3 light, and directing the light to the region of skin.

1 ⁹~~40. The method of claim ⁸39, wherein the step of~~
2 ~~producing includes the step of pulsing the laser light.~~

1 ¹⁰~~41. The method of claim ⁹40, wherein the step of~~
2 ~~pulsing includes the step of delaying in the range of~~
3 ~~0.5-10msec between pulses.~~

1 ¹¹~~42. The method of claim ⁹40, wherein the step of~~
2 ~~pulsing includes the step of providing pulses having energy~~
3 ~~fluences on the order of 100J/cm².~~

Sub 1 43. An apparatus of cutaneous resurfacing of a
a9 2 region of skin comprising an Er:YAG laser light source
3 disposed in a housing capable of directing light to the
4 region of skin.

1 44. The apparatus of claim 43, wherein the laser
2 light includes a pulse forming circuit.

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45. The apparatus of claim 44, wherein the pulse forming circuit includes a pulse delay circuit for producing a delay in the range of 0.5-10msec between pulses.

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46. The apparatus of claim ¹²43, wherein the light source is capable of providing pulses having energy fluences on the order of 100J/cm².

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47. An apparatus for the cutaneous resurfacing of a region of skin, including skin resurfacing or wrinkle smoothing, which comprises: an incoherent light source such as a flashlamp; an Er:YAG laser which can be operated in multiple pulse mode; a delivery system disposed to deliver the incoherent light and laser light to the region.

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7. The method of claim 2 wherein the step of cooling includes the step of applying a transparent substance to the region of skin and reducing the temperature of the substance.

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8. The method of claim 7 wherein the substance is ice.

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9. The method of claim 7 wherein the substance is a gel.

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10. The method of claim 2 further including the steps of controlling a pulse duration and applying multiple pulses to control a temperature distribution within the skin.

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11. The method of claim 1 wherein the step of applying pulsed light includes the step of pulsing a laser.

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12. The method of claim 11 wherein the step of pulsing a laser includes the step of pulsing a Nd(Yag) laser.

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13. The method of claim 11 wherein the step of pulsing a laser includes the step of pulsing a ruby laser.

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14. The method of claim 1 wherein the step of applying pulsed light includes the step of pulsing a noncoherent light source.

1 22. The method of claim 21 further including the
2 step of controlling a delay time between the application of
3 the substance and the application of light, to control the
4 temperature distribution.

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1 23. The method of claim 20 wherein the step of
2 cooling includes the step of applying a transparent
3 substance to the region of skin and reducing the temperature
4 of the substance.

1 24. The method of claim 20 further including the
2 steps of controlling a pulse duration and applying multiple
3 pulses.

1 25. An apparatus for treating a region of skin
2 comprising a pulsed light source capable of heating
3 collagen and shrinking the collagen, thereby reviving
4 the elasticity of the collagen and of the skin, a
5 housing, in which the light source is disposed, wherein
6 the housing includes an aperture suitable for directing
7 the light to the region of skin.

1 26. The apparatus of claim 25 further including a
2 timer, connected to the pulsed light source, for indicating
3 when a delay time has passes after an application of a
4 cooling substance to the skin region.

1 27. The apparatus of claim 25 wherein the pulsed
2 light source includes a microprocessor for determining the
3 delay time in response to a selected skin temperature
4 profile.